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ECONOMIC AND POLITICAL DETERMINANTS OF
INFLATION RATES: AN EMPIRICAL INVESTIGATION
USING A PANEL DATA SET

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1. Introduction

There is a wide variation of inflation rates across countries as well as over time within some countries. The important role of inflation rate as an indicator of macroeconomic economic performance has led to a large body of theoretical work attempting to explain and identify the determinants of inflation rate patterns. The broad spectrum of theoretical explanations of the observed patterns of inflation rates can be subsumed under three categories. A "fiscal view" of inflation stressing the importance of seigniorage taxation as a source of revenue for the government. A "time inconsistency" view of inflation emphasizing the notion of surprise inflations engineered by governments in order to stimulate the level of economic activity. Finally, "political theories" of inflation focusing on political distortions, and conflicts of interest among different social groups as explanatory factors. In particular, high political instability, defined as high propensity of government change, has been argued to lead to high inflation.

The objective of this paper is to empirically investigate the impact of economic and political variables, that have been suggested as important in the theoretical literature, in determining inflation. For this purpose we undertake a simultaneous equations approach where inflation and propensity of government changes are jointly determined. The data set used is a panel data set for 113 countries over the 1960-1982 period.

The primary finding of this study is that high inflation increases the current propensity of government change, but the inflation rate is not significantly affected by the current propensity of government change. Other results of interest are: openness to trade has a negative impact on inflation, negative shocks to GDP growth increases inflation, and past executive adjustments in the composition of governments lead to high inflation.

In a study closely related to ours, Cukierman, Edwards and Tabellini (1992), using cross-section data, estimate the ratio of seignorage tax to tax revenues as a function of government change propensity (political instability). The propensity of government change is estimated in a prior stage. The authors report that political instability leads to high inflation rate. Using our simultaneous estimation, however, we find that the causality is not from political instability to inflation, but from inflation to political instability.

Our finding that openness has a negative impact on inflation is consistent with Romer (1991) who suggests that openness is a commitment device to low inflation rates. The same variable has been interpreted to capture the availability of better technologies for tax collection since imports and exports might be an easy tax base for collecting revenues (Cukierman et al.(1992)).

The rest of the paper is organized as follows: In Section 2 we present a survey of theories of inflation, discussing the empirical implications of each model. In Section 3 our data and its main features are described. Section 4 contains the econometric methodology, and Section 5 contains our empirical specification. In section 6 we present our basic estimation results, and sensitivity analysis of the results. Section 7 concludes.

2. Alternative Theories of the Determinants of the Inflation Rate and Empirical Implications

We discuss alternative views of inflation, with the purpose of identifying potential empirical determinants of inflation rates. These alternative views differ based upon their emphasis on fiscal considerations, or time inconsistency considerations, or political economy considerations.

2.1. The "fiscal view" of inflation: seigniorage taxation.

The origins of fiscal view of inflation is based on the observation that seigniorage taxes constitute a significant form of revenue in many developing countries. For example in the 1970s, seigniorage revenues represented more than 10% of all government revenues in over 20 countries (see Cukierman et al. (1992) and Fischer (1982)). There are two main variants of theories with fiscal view. These two primarily differ on whether the government is constrained in its ability to borrow to finance deficits, or not.¹

One version of fiscal view is the theory of optimal seigniorage.² In this view, fiscal authorities choose inflation rate, and fiscal deficit to reduce the excess burden of all forms of taxation (including seigniorage taxation) by maximizing a well defined welfare function, which represents the preferences of private agents.

The theory of optimal seigniorage identifies several important determinants of inflation.³ First, the equilibrium inflation is higher when costs of raising income

¹ The fiscal roots inflation are stressed in the literature on financial repression (McKinnon (1973), Shaw (1973)), and in recent models of financial repression and growth (Roubini and Sala-i-Martin (1992a, b)). Studies of high inflation and hyperinflation episodes such as Cagan (1956), Sargent (1983), Dornbusch and Fischer (1993) and Vegh (1992), also contain a fiscal view.

² The optimal seigniorage theory originates in Phelps (1973). Variants of a fiscal view of inflation are also at the basis of the wide literature on the optimal taxation of money (Helpman and Sadka (1979), Sargent and Wallace (1981), Drazen (1984), Faig (1988), Kimbrough (1988)). The optimal seigniorage approach has been recently reformulated in Mankiw (1987) who extends the "tax smoothing" model of Barro (1979, 1986) to the choice of the inflation tax.

³ The theory also implies that inflation rates (and tax rates) should follow a random walk without drift. Moreover, for a given constant relative cost of inflation versus other distortionary taxes, tax rates and inflation rates should be positively correlated or, more formally, cointegrated (optimal seigniorage). These implications have been repeatedly rejected both for developed and developing countries. While Mankiw (1987) found some evidence in favor of optimal seigniorage in the United States, the evidence in Poterba and Rotemberg (1990), Grilli (1990) and Roubini and Sachs (1989 a, b) for other industrialized countries tends to reject the theory for most industrial countries. Similarly,

taxes are high relative to the distortionary costs of inflation. The costs of raising income taxes are higher in countries characterized by inefficient tax systems. Second, for a given cost of seigniorage tax relative to other forms of taxation, inflation is higher in countries with a higher permanent amount of government spending relative to the size of the economy. Third, as long as the government is not constrained in its ability to borrow and lend, transitory shocks to output ⁴ and government spending should not lead to changes in tax rates and inflation rates. Hence, budget deficits and surpluses should not be correlated with inflation rates. Finally, a high tax base on which to raise seigniorage revenues (relative to the size of the economy) should be associated with a higher equilibrium inflation rate.

While there is large evidence that seigniorage is an important source of revenues, the empirical evidence on the strict implications of theory of optimal seigniorage is mostly negative.⁵ Nevertheless, some variables suggested by the theory are found to be important in explaining inflation rates. Notably, Cukierman et.al.(1992) and Edwards and Tabellini (1991) consider: the sectoral composition of GDP to capture the idea that agriculture is harder to tax than manufacturing and mining; measures of economic development such as per capita GDP, industrial country indicators since more developed countries will have better technologies for enforcing tax collection; the degree of openness of an economy since imports and export might be an easy tax base for collecting revenues; measures of urbanization to proxy for the

Tabellini and Edwards (1991 a) and Roubini (1991) reject the theory for a large sample of over 100 developed and developing countries. For example, inflation rates and tax rates are negatively correlated in many countries, a result at odds with one of the central implications of the optimal seigniorage theory.

⁴ Transitory shocks to terms of trade could be also included separately in the model or, alternatively, considered as part of the transitory shocks to output.

⁵ See footnote 3 above.

fact that tax collection costs might be smaller in more urbanized countries. A number of these variables are found to be important determinants of cross section differences of seignorage revenues.

An alternative fiscal view of inflation is based on the observation that many developing countries do not have well functioning domestic bond markets and that their access to foreign borrowing might be severely constrained. For example, in the "endogenous switching model" of Grilli and de Kock (1989)⁶, government borrowing is ruled out and large shocks to government spending trigger endogenous regime switching from a fixed exchange rate equilibrium (with low inflation and seigniorage) to a flexible exchange rate equilibrium (with high inflation and seigniorage). This view which considers inflation as a "residual" form of taxation, has very different implications than the optimal seigniorage approach. Unlike in the optimal seigniorage approach, shocks to spending and output that lead to increased primary deficits are financed through monetary creation hence lead to increased inflation.

Empirical implications of inflation as a "residual seigniorage" approach are as follows. First, for a given spending path, and constant tax rates, high inflation should be observed during economic recessions, as during recessions income taxes and other direct and indirect tax revenues tend to fall.⁷ Second, given fixed tax rates, high inflation should be observed under conditions of large transitory shocks to government spending.

⁶ See also Calvo and Guidotti (1992), Calvo and Leiderman (1992), Aizenman and Hausman (1994) and Roubini and Sala-i-Martin (1992a,b) for other models stressing inflation as a residual form of taxation.

⁷ Indirect evidence is provided in Roubini (1991) finds evidence that nominal (inflation unadjusted) fiscal deficits are significantly associated with growth slowdowns in a cross-sectional sample of developing countries after controlling for other determinants of fiscal deficits. The residual approach could also explain why inflation and tax rates are negatively rather than positively correlated for many developing countries.

2.2 Time consistency models of inflation

A second strand of economic literature models the inflation process as the outcome of a credibility game between governments and the private sector. The seminal contributions here are Barro and Gordon (1983a,b). If the government's target level of output is higher than the private sector's, the announcement by the government of a zero inflation policy is not credible or time consistent. The private agents, in forming their rational expectations of inflation, realize that the government has an incentive to try to engineer unexpected inflation in order to stimulate output. In a time consistent equilibrium, rational inflationary expectation are such that no surprise inflation occurs, output remains at its natural level, and inflation rate is higher than its socially optimal level. This inflationary bias is greater the greater is the weight on output relative to inflation in the policy maker objective function, the greater is the gap between the government's and the private sector's output targets, or the higher is the elasticity of output with respect to inflation.

The Barro and Gordon model of inflation has led to a large body of literature on credibility and reputational models of inflation.⁸ One empirical implication suggested by Rogoff (1985), is that the appointment of a conservative central banker, with preferences that are less biased towards inflation, might solve the credibility problem of the government and lead to lower inflation rates. Alesina (1988), Alesina and Summers (1990), Grilli, Masciandaro and Tabellini (1991) and Cukierman, Webb and Neyapti (1991) have found strong evidence that low inflation rates are associated with independent central banks. However, central bank independence and the inflation process are potentially endogenous. Indeed, causality tests indicate that while there is an effect of independence on inflation, high inflation might also cause lack of

⁸ See Persson and Tabellini (1991) for a systematic survey of such a literature.

central bank independence (see Cukierman et al. (1991)).

Another empirical implication of this class of models concerns the exchange rate regime. Giavazzi and Pagano (1988), Giavazzi and Giovannini (1990) suggest that government could solve its credibility problem by fixing the exchange rate with respect to another country, which is credibly committed to low inflation. Empirical investigations provide only a weak support for this hypothesis (see Collins (1988), Giavazzi and Giovannini (1990), Weber (1991)).⁹ Moreover, alternative theory and evidence suggest that inflation causes the exchange rate regime rather than the reverse.¹⁰

Finally, in an extension of Barro-Gordon model, Romer (1991) shows that, the ex-ante elasticity of output with respect to inflation is smaller in more open economies, and hence concludes that inflation bias should be lower in countries that are more open to trade. The explanation relies on the fact that the pass-through effect of exchange rates on prices is higher the larger is the share of imported goods in the consumption basket. In a cross-sectional sample of countries, Romer finds empirical evidence that the average inflation rate is lower in countries that are more open. Here again, one must use caution in that the association of high inflation with low openness might be spurious. Countries that are forced to rely on seigniorage taxes and high inflation might be the same as those that decide to pursue policies of trade repression.¹¹

⁹ They models do not explain why the cost of reneging on the commitment to fixed rates are higher than those of reneging on a monetary rule announcement.

¹⁰ See Grilli and Kock (1989) for a model where inflation affects the choice of exchange rate regime, and Edwards (1992) for some evidence consistent with this view.

¹¹ See Roubini and Sala-i-Martin (1992a) for an explanation along those lines. Note also that Cukierman, Edwards and Tabellini (1991) explain the empirical association of high inflation with low openness with a fiscal rather than reputational channel.

2.3. Political theories of inflation.

In this class of models, political distortions of various nature are the source of inefficiently high rates of inflation. Cukierman et. al. (1992) derive a model that builds on the Alesina and Tabellini (1990) model of fiscal deficits. In this model, the political distortion derives from the assumption that different parties with different preferences over the type of public good alternate in power according to exogenous reelection probabilities. If it takes time to change a tax system, the political distortion leads to the choice of an inefficient tax system by the incumbent government, tying the hands of the future government, and forcing it to rely more on seignorage taxation than other forms of taxes. The model implies that political instability and ideological polarization leads to high inflation rates and seignorage taxation. The authors test the theory using cross-sectional data and find strong evidence that a high degree of polarization and political instability lead to a higher ratio of seignorage taxation relative to other taxes.

A potential drawback of this approach is simultaneous equations bias, though the authors use instrumental variables approach to address this potential problem. The possibility of reverse causality between inflation and political instability has been suggested in a number of studies. Robertson (1983) finds that economic variables such as high inflation and unemployment significantly affect the probability of government change. Empirical models of voting behavior (Fair (1976)) suggest that the probability of an incumbent administration being booted out of power is significantly affected by the economic performance of the government, in particular inflation rates and economic growth.

An alternative genre of political models of inflation builds on the idea of "wars of attrition". Alesina and Drazen (1991) model the delay in fiscal stabilization policies as the result of a "war of attrition" between two different social classes.

The conflict is about which social class bears the tax burden of stabilization. The model implies that a greater dispersion in the income distribution and a lower degree of political cohesion causes a delay in the expected date of stabilization and therefore implies a greater and prolonged pre-stabilization period of fiscal imbalance.¹²

Mondino, Sturzenegger and Tommasi (1994) also investigate the relation between inflation and distributional conflict in a model, where inaction, delays and reversal in inflation policy take place in a deterministic setting. They argue that the government is just a perfect agent for the pressure groups and is not pursuing its own policy goals. In their model the economy cycles between periods of high inflation resulting from the redistribution conflict and periods of low inflation and cooperation that arise when the costs of high inflation are too high.¹³

A number of other studies also focus on political instability, social polarization, and inequality in income distribution in explaining high inflation rates. Especially contributions on the Latin American "populism" (see Sachs (1989), Dornbusch and Edwards (1989), Conliff (1982)) suggest that inequality in distribution of income is an important source of social and political conflict and, in turn, the political instability that ensues from poverty and inequality leads to fiscal deficits and high inflation.

Finally, "partisan theories" (Alesina (1987)) and "political business cycle" (PBC) theories (Nordhaus (1975)) of macro policy-making imply cyclical movements of inflation based on the partisan nature of the government in power and as a result of

¹²Extensions of this approach are undertaken by Drazen and Grilli (1990) and Guidotti and Vegh (1992).

¹³Havrileski (1990) presents a similar view of the inflation cycle. A similar approach to strategic conflict and inflation is taken by Patinkin (1993), Aizenman (1992) and Tabellini (1986).

pre-electoral manipulation of the economy. Evidence in favor of such partisan and political business cycle effects on the inflation rate has been found in a number of recent empirical studies (Alesina and Roubini (1992), Alesina, Cohen and Roubini (1992, 1993)) for a large sample of OECD countries. Similar evidence for developing countries is more limited¹⁴.

To summarize, the broad body of literature discussed above suggests several categories of variables as potential determinants of inflation. These are the structural aspects of countries tax systems, the size of permanent government spending, constraints to the ability of governments to borrow and negative growth shocks (recessions) especially if the government is constrained in its borrowing ability as suggested by the fiscal view. Various commitment mechanisms, which might be central bank independence, fixed exchange rate regimes, or openness to trade as described in the time consistency view. Finally, variables that capture political conflict, political instability as described in the political economy view of inflation. Our approach in this empirical undertaking is not to test one of these models but to investigate the contribution of these considerations.

3. Data

Our panel data set includes information on 113 countries for the 1960-82 period. A list of countries is in Table A.1 in the Appendix. A complete list, along with definitions and sources of each variable is provided in Table A.2. The sources for our economic data are Summers and Heston (1988) and IMF-IFS; the main source for political data are Jodice and Taylor (1983) and Banks (various issues).

We describe three alternative measures of government change. The variable (GCHANGE) is obtained from Taylor and Jodice (1983), and it takes the value of one when

¹⁴ See Ames (1987) for some evidence of PBC and partisan effects in Latin America.

there is a regular or irregular (i.e. military coup) transfer of executive power, and zero otherwise. The second measure is major government changes (MJCHANGE). This variable takes the value of one for all transfers that involve a substantial turnover of leadership, i.e. all irregular transfers of power and the subset of regular transfers of power which imply a change in the party, or coalition of parties in office. Finally the variable (COUP) captures on irregular transfers of power.

The basic features of our data are presented in Table 1. In discussing this table we will focus only on the patterns of government change variables and inflation. The mean values for (GCHANGE), (MJCHANGE), and (COUP) for the sample of all countries are 0.28, 0.11, and 0.045, respectively. These measures of government change show significant variability across different regions of the world.

In the industrial countries the frequency of total government changes is (0.39), but major government changes are much more infrequent (0.12), and military coups are practically non-existent.

Average frequency of total government changes in Latin America is (0.29), which is almost identically to the world average. But Latin America has the highest frequency of major government changes (0.16) and of military coups (0.078) in the world.

In Africa, total government changes (and in particular regular ones) are quite unlikely: African countries are typically authoritarian regimes with very few regular elections and change in power. In this region, government changes take mostly the form of major changes (0.11), out of which military coups are more than half (0.06).

In Asia, government changes are close to the world average (0.30) but major government changes are much lower than in any other region; moreover, with the exclusion of the industrial countries, the frequency of coups is the lowest in Asia.

Finally, the OTHER region, which includes Greece, Malta, Portugal, Turkey,

Yugoslavia and Cyprus, shows 0.37, 0.16, and 0.058 for GCHANGE, MJCHANGE and COUP respectively

The average inflation rate in the entire sample is 12.6% but there is a wide dispersion of inflation rates across time and regions as indicated with its standard deviation of 35.3%. The region with the highest average inflation rate in the period is Latin America (19.5% per annum over the period). Asia comes next with an average inflation rate of 14.1% per year. Average inflation rate are relatively lower among the industrial countries (7.9%), African countries (9.8%) and the economically less advanced European countries (11.1%).

Table 2 presents the averages of inflation rates for the years with government changes and the years with no government changes. The first column considers the sample of all countries. The average inflation rate in a year without government changes is 15.7% and it is significantly lower in years with a government change (11.3%). The difference is even greater if we consider major government changes: average inflation is equal to 20.1% in years with a major government change and half as much (11.6%) in years without a major government change. The inflation gap is the largest and most striking for coups years: the average inflation rate in a country-year when a military coup occurred is 31.1% compared to a 11.6 % in years without a coup. F-tests confirm that all of these differences are statistically significant.

The other four columns of Table 2 show that the same empirical observations are not common to every region of the world. In general inflation is, on average, lower in years with no change and higher in years with government changes; it is also higher in ascending order in years of government change, major government change and coups. However, there are some significant regional differences. The difference in inflation rates between years with and without some government change in Latin America (25.6% against 17.0%), Asia (20.5% versus 11.7%) and other low income European countries

(16.2% versus 8.1%) is statistically significant; however, such difference is not statistically significant in industrial countries (8.4% versus 7.2%), and in Africa (9.6% versus 9.9%). In Latin America, Asia and low-income European countries the inflation differential between years with a without change increases as we move from total government changes to major government changes and to years of military coups.

In Table 3, inflation rates starting two years prior to a government change and up to two years after the government change are presented. In years with a government change the inflation rate averages 15.7%; in the two years before the change the inflation is lower but increasing (from 11.1% two years before a change to 13.8% a year before the change). In the two years after a government change the inflation rates remains at a higher level (15.3% a year after and 16.8% two years after). In summary, the inflation rate appears to be accelerating the in the two years leading to a government change and remains at a higher level in the two years after a government change. Conversely, no significant differences in inflation rates are observed in the years before and after those in which no government change has occurred.

The patterns described above yield important insights into relations between government change and inflation patterns. These patterns, however, are not sufficient to gain insights into relations between inflation and anticipated government changes, which is the relevant variable, as in the theoretical models of political instability described above. Furthermore, these correlations cannot help identify the nature of causation between inflation rate and anticipated government change. In order address these issues we use a model of joint determination of government change and inflation described in the next section.

4. Methodology

3.1 A Simultaneous Equations Approach

Let us define the following structural equation system, where the dependent variables are annual observations of government change and inflation, and where time subscripts are omitted:

$$\begin{aligned} c^* &= \alpha_c X_c + \beta_c X + \gamma_c p + u_1 \\ p &= \alpha_p X_p + \beta_p X + \gamma_p c^* + u_2 \end{aligned} \quad (1)$$

c^* = a latent variable such that when $c^* > 0$ we observe a government change and $c^* \leq 0$, we do not observe a change,

p = annual rate of inflation,

X = exogenous variables that determine both government change and inflation,

X_c = exogenous variables that determine the occurrence of government change only,

X_p = exogenous variables that determine inflation only,

u_1, u_2 = bivariate normal errors.

The coefficients γ_c and γ_p take into account the contemporaneous feedback between inflation and changes of government, while the α and β coefficients measure the effects of the exogenous variables. One way of identifying the system requires that at least one each of the X_c and X_p variables exist; that is, we need one exogenous variable in the inflation equation which is not in the equation for government change, and vice-versa.¹⁵

Because one of the endogenous variables is a latent variable, standard econometric methods for simultaneous equations systems cannot be applied. Newey (1987) shows how to estimate this type of system through an application of Amemiya's Generalized Least Squares Technique (Amemiya (1978)). A description of this method is available upon request.

¹⁵ An alternative way of identifying the system of equations is to impose restrictions on the contemporaneous feedback, i.e. $\gamma_c = 0$ or $\gamma_p = 0$.

5. Model Specification

The explanatory variables in our government change equation can be classified in three broad classes: 1) indicators of political unrest such as past cabinet adjustments and past government changes; 2) "structural" institutional variables which account for differences across countries such as the degree of openness, GDP per capita, being a democracy or not and regional dummies; 3) economic performance in the recent past, in particular the recent rate of inflation.

Our basic specification for government change equation includes: the contemporaneous inflation rate (INF), one and two years lagged inflation rates (INF(-1)), (INF(-2)) respectively. We include lagged executive adjustments, (EXADJ(-1)), as an indicator of incipient political unrest, the lag of government change (GCHANGE(-1)), in order to test for persistence of political instability, Latin American and African region indicators to capture the institutional features (the electoral laws, history of democracy and authoritarianism) of these regions.

Our basic specification of the inflation equation contains lags of the inflation variable, (INF(-1)) and (INF(-2)), to capture its persistence. Lagged value of GDP growth, (GROWTH(-1)) is included to capture growth shocks (recessions) that reduce tax revenues and might intensify the reliance on inflationary finance. (EXADJ(-1)), and LATIN are also included in this equation.

We use both economic and political variables to identify the inflation and government change equations. The variable (GROWTH(-1)) enters in the inflation equation only, while lag of government change (GCHANGU(-1)) and AFRICA enters in the government change equation only. These restrictions (one in inflation equation and two in government change equation) leave us with one testable over identifying restriction; we discuss these tests in the next section. Needless to say, the choice of identifying restrictions is always open to criticism. Therefore, we later discuss sensitivity on

the model specification.

6. Results of the Joint Estimation

In Table 4 we present the results structural estimation. The first column corresponds to our basic specification. Inspection of these results suggests the following findings concerning the contemporaneous feedback effects: 1) The impact of political instability on inflation is not statistically significant. 2) High inflation is found to increase the propensity of government change. These findings are of significant interest in view of the recent empirical work. In particular Cukierman et al. (1992) find that instability leads to high inflation in the context of a single equation estimation method which does not address the joint endogeneity of inflation and instability. Our finding that high inflation leads to government turnovers is consistent with that of Robertson (1983), and Fair (1976).

Let us now turn to the other determinants of inflation. The coefficients on the economic variables in this equation have the expected signs. Our proxy for lagged growth shocks to the economy ($GROWTH(-1)$) is negative but significant only at low levels of confidence: recessions are associated an increase in reliance on seigniorage revenues (higher inflation). One year lagged value of inflation is positive and again significant at low levels of confidence, suggesting weak evidence for inflation persistence. The Latin American indicator variable is positive and statistically significant, capturing the impact of unobserved characteristics of this region that lead to the higher than average inflation rates in this region. Finally, the lagged executive adjustments indicator ($EXADJ(-1)$) positively and significantly affects the inflation rate.

The results for the government change equation indicate that high inflation in the past reduces the propensity of government change. This result appears puzzling at first sight. It is important to note that this result is obtained after the

contemporaneous impact of inflation on government change and the persistence of government change are controlled for. The occurrence of executive adjustments (EXADJ(-1)) does not increase the likelihood of a government change. Furthermore, government changes tend to be "persistent": a government change in the recent past increases the likelihood of another change. Finally, both of the region specific dummy variables are found negative and significant.

The chi-squared test of our over-identifying restriction shows that the model is not rejected at the .77 level of significance.¹⁶

In columns 2-5 we present some alternative specifications to display the robustness of our main findings that high inflation increases the contemporaneous propensity of government change, but high propensity of contemporaneous government change does not have an impact on the inflation rate. In column (2) OPEN is incorporated to both equations of the model. The chi-squared tests of our over-identifying restriction do not reject our model at a high levels of confidence as indicated with the p-value of 0.93. The openness variable reduces the level of inflation and its impact is significant at low levels of confidence. This finding is consistent with Cukeirman et al. (1992) and Romer (1991). The interpretation of this variable is not as clear as argued in either of these studies. It might capture the availability of an easy to tax base, or commitment to low inflation as have been argued in these studies, respectively. In either case there is a potential for the endogeneity of this variable. However, it should be observed that openness changes more slowly over time relative to inflation.

In column (3) we use the lagged growth variable interacted with the standby agreement variable (GRO*STB). This is in an attempt to proxy the periods and

¹⁶ A high value for the test statistic (and correspondingly, a low p-value) would have indicated that data reject our identifying restrictions, casting doubt on our results.

countries which are externally credit constrained in periods of negative growth shocks.

The variable itself is not found statistically significant, and the remaining results are as before. Moreover, introducing a stand-by dummy separately in the regression does not improve the results: this variable remains insignificant.

Specifications presented in columns four and five are both attempts to use economic or political variables as identifiers of the government change equation instead of the African region indicator. As presented in column (4), we use the level of GDP in 1960 in place of AFRICA. The results in column (5) are from a specification that incorporates our indicator for the degree of democracy (DEMOC). We find that government change is more likely in countries that have higher levels of GDP60, and also in countries and periods which are more democratic (i.e. for low values of the variable DEMOC). Neither of these specifications perform as well in terms of the chi-squared statistics of the model in comparison to the earlier specifications. The results, however, are generally consistent with the earlier ones. In particular we continue finding the same results concerning the contemporaneous affects: high inflation causes high government change but high government change does not cause high inflation.

6.1 Alternative Specifications

In an attempt to incorporate the implications of various approaches to inflation in our empirical investigation we consider a large number of alternative specifications. All the alternative specifications discussed below were rejected on the basis of chi-squared tests.

First, we incorporated structural variables that have been argued to make collection of direct taxes more costly (as in Cukierman et al. (1992)). These variables include the sectoral composition of GDP, measures of economic development such as per capita GDP, industrial country indicators, and a measure of urbanization. We

incorporated these variables either in both of the equations or only in the inflation equation as an identifying variable. In the latter case the shocks to previous years growth ($GROWTH(-1)$) have been employed in both equations. All these permutations were rejected.

Second, we used two variables that have been argued to proxy for the commitment of governments to a low inflationary path. These variables include a measure of central bank independence (the turnover rate of central bank leaders) and a measure of whether the exchange rate is fixed, flexible or managed float. As above, these variables were employed either in both of the equations or only in the inflation equation as an identifying variable. In the latter case the shocks to previous years growth have been employed in both equations. While in some specifications these variables enter significantly and with the right sign in the structural inflation equation, all these specifications were rejected on the basis of chi-squared tests.

Finally, we have used variables capturing the central government fiscal position. Government revenues, expenditures (net of interest payments) individually as well as the (non-interest) fiscal deficit were all considered as identifiers of the inflation equation, or in both equations while inflation is identified with lagged value of growth. Again, all these models were overall rejected on the basis of chi-squared tests in spite of evidence of a significant effect of the (non-interest) deficit variable on the inflation rate.

6. Concluding Remarks

This paper is an attempt to identify economic and political determinants of inflation for a large set of countries during the 1960-1982 period. For this purpose we undertake a simultaneous equations approach where inflation and propensity of government changes are jointly determined. We find that inflation rate is not

significantly affected by propensity of government changes, but high inflation increases the propensity of government change. Other results of interest are: openness to trade has a negative impact on inflation, negative shocks to GDP growth increases inflation, and past executive adjustments in the composition of governments lead to high inflation.

Since past executive adjustment might be a proxy for political instability, this result might be interpreted as suggesting that, while political instability does not contemporaneously affect the inflation rate, it does so with a lag.

Our results, while quite robust in some respects, are still preliminary. We plan to consider in more detail some economic determinants of inflation rates. Since seigniorage appears to be an important source of revenue for many governments, a more systematic exploration of alternative fiscal hypotheses and variables is necessary. Moreover, while the overall evidence does not provide support for "commitment" models of the inflation rate, an additional effort in that direction is warranted as well. Finally, as in Alesina, Ozler, Roubini and Swagel (1992), we should distinguish between total government changes and other measures of government instability, such as military coups and government changes that lead to major political changes. This will allow us assess whether the effect of high inflation on the probability of government collapse is evident only in the cases of drastic political conflict or it is an empirical regularity across political regimes and institutions.

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Appendix

Countries, Variables and Sources

Table A.1

Countries and Sample Period (+)

Sample 1950-82 (60 Countries)	Sample 1960-82 (39 Countries)	Other** (14 Countries)
U.S.*	Yugoslavia*	Malta* (1954)
U.K.*	Haiti*	Jamaica* (1953)
Austria*	Barbados*	Israel* (1953)
Belgium*	Surinam	Jordan* (1954)
Denmark*	Kuwait	Bangladesh* (1959)
France*	Saudi Arabia	Indonesia* (1962)
Germany*	Syria	S. Korea* (1953)
Italy*	Hong Kong*	Malaysia* (1955)
Luxembourg*	Nepal*	Benin (1959)
Netherlands*	Singapore*	Ghana* (1955)
Norway*	Algeria*	Malawi* (1954)
Sweden*	Botswana*	Zimbabwe* (1954)
Switzerland*	Burundi*	Sudan* (1955)
Canada*	Cameroon*	Zambia* (1955)
Japan*	Cape Verde	
Finland*	Central African Republic*	
Greece*	Chad	
Iceland*	Congo	
Ireland*	Gabon*	
Portugal*	Gambia*	
Spain*	Guinea-Bissau	
Turkey*	Ivory Coast*	
Australia*	Lesotho	
New Zealand*	Liberia*	
South Africa*	Madagascar*	
Argentina*	Mali	
Bolivia*	Mauritania	
Brazil*	Mozambique	
Chile*	Niger	
Colombia*	Rwanda*	
Costa Rica*	Senegal*	
Dominican Republic*	Sierre Leone*	
Ecuador*	Somalia	
El Salvador*	Swaziland*	
Guatemala*	Tanzania*	
Honduras*	Togo*	
Mexico*	Tunisia*	
Nicaragua*	Fiji*	
Panama*	Papua New Guinea*	
Paraguay*		
Peru*		
Uruguay*		

Venezuela*
Guyana*
Trinidad*
Cyprus*
Egypt*
Sri Lanka*
Taiwan*
India*
Pakistan*
Philippines*
Thailand*
Zaire*
Ethiopia*
Kenya*
Mauritius*
Morocco*
Nigeria*
Uganda*

(+) While the original sample includes some countries with data going back to 1950, we run all the regressions with the 1960-1982 sample.

The end of the sample period is 1982 for all countries, except South Korea and Hong Kong, for which political data is available only through 1977.

** The date next to each country in this group indicates the beginning of the sample for which data are available.

Table A.2

Variables Used in Government Change Equations

Dependent variable

GCHANGE = Government change. Dummy variable which takes a value of 1 for the years in which there is either a coup or a regular government transfer, and a value of 0 otherwise. [Source: Jodice and Taylor (1983)]. We found several coding errors in this variable which we adjusted.

Explanatory variables

Political variables:

DEMOC = Democracy variable taking value 1 for democratic regimes, 2 for regimes mixing democratic and authoritarian features, 3 for authoritarian regimes. [Source: Authors' construction from Banks, various issues].

EXADJ = Dummy variable which takes the value of 1 in years in which there is a change in the composition of the executive not resulting in government transfers. [Source: Jodice and Taylor (1983)].

Economic variables:

Inflation lags (INFL1 and INFL2) - One and two year lagged values of CPI inflation rate [Source: IMF International Financial Statistics]

OPEN = The sum of exports and imports scaled by GNP [Source: IMF International Financial Statistics]

GDP60: Per capita GDP in 1960

Regional dummy variables:

LATIN = A dummy variable for South America and Latin America.

AFRICA = Dummy variable for Africa.

Variable Definitions for Inflation Equations

Dependent variable:

Inflation rate = Annual rate of CPI inflation. [IMF International Financial Statistics]

Explanatory Variables:

GROWTH (-1) = Lagged value of annual rate of growth of per capita GDP. [Source: Constructed from Summers and Heston (1991)].

GRO*STB = This variable is the interaction of lagged growth rate and the lagged standby agreement variable. Standby agreement dates are collected from IMF Annual reports.

Other variables are defined above.

Table 2

	ALL	OTHER	INDUST	ASIA	LATIN	AFRICA
GCHANGU=1	15.7	16.20	8.45	20.52	25.62	9.66
GCHANGU=0	11.35	8.17	7.23	11.74	17.04	9.91
MJCHANG=1	20.10	14.56	9.66	42.69	26.81	10.30
MJCHANG=0	11.63	10.49	7.44	11.85	12.14	9.82
COUP=1	31.16	23.56	—	66.34	34.35	10.64
COUP=0	11.67	10.37	7.70	11.75	18.24	9.82

Table 3

Temporal pattern of the relation between inflation and political instability

Average inflation in period $t-i$

	$t-2$	$t-1$	t	$t+1$	$t+2$
t = a year with a government change	11.1%	13.8%	15.7%	15.3%	16.8%
t = a year without a government change	11.6%	11.4%	11.3%	12.0%	11.9%